ROUND TABLE SESSION #7 - J.H. Hulse - September 1974

RESEARCH AND DEVELOPMENT IN ADVANCED COUNTRIES AND TRANSFER OF RESULTS FOR INDUSTRIAL DEVELOPMENT TO DEVELOPING COUNTRIES

The term "transfer of technology" has come to mean the transportation of a technological device or system from one place to another. In recent years it has been much concerned with the transfers of technological ideas and processes between the more developed and the less developed nations of the world.

It has been estimated that, in terms of total cost, more than 95% of the world's research is carried out in North America and other developed countries and less than 5% in all of the LDCs together. Considering the relative importance of food processing and distribution to the economies of the developed countries, one might expect to find significant transfers of useful food technologies from the richer to the poorer nations. In actual fact, the contribution of the developed countries to the less developed countries of practically useful systems of food transformation, preservation and distribution appear to be comparatively meagre and in many instances the technological transfers which have been attempted have proved inappropriate to the needs and conditions of the developing nations.

Within this brief paper it might be useful to try to explore some of the reasons why technological transfers have in the past failed and how more successful cooperation between the technologists of the more developed and less developed countries might be encouraged in the future. The subject will be discussed under four headings: 1) general philosophy and level of mutual understanding; 2) education and training; 3) research systems; and 4) direct industrial transfers.

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1. General Philosophy and Mutual Understanding

There is a growing body of circumstantial evidence to suggest that the majority of scientists and technologists and scientific institutions in developed countries possess a very inadequate knowledge and awareness of the priorities, problems and conditions of developing countries. The many failures of attempted transfers of technology bear witness to the difficulty of transferring technologies between countries widely different in cultural heritage, technical and economic development. There is also an apparent tendency in developed countries to regard all less developed countries as a single block: "the third world", and to assume that they all suffer from identical problems and more or less equal levels of poverty and malnutrition. It does not appear to be recognized that greater differences in economic, social and technical development are to be found among the so-called less developed nations than between some of the less developed and those classified as "developed". India includes among its citizens a far larger number of university graduates in food and related sciences than are to be found in many so-called developed countries. The Government of India supports what is probably the largest food research institute in the world. The Universities of Egypt were teaching science related to food and agriculture long before the first university was established in North America.

Much of the ill-considered advice given to the developing countries by so-called "experts" from the developed appears to be based on the assumption that what is good for developed nations must essentially be good for the less developed. It presumes that the philosophies which guide food research and development in North America and Europe are valid for the struggling economies

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of many African, Asian and Latin American countries.

Industrial food research in developed economies in North America and Europe is predominantly concerned with, first, the creation of new products and processes, and second, with quality control. Both product and process research and development are aimed primarily at saving labour. The growing spectrum of "convenience" foods, in the form of canned and frozen, pre-cooked meals, and prepared mixes of soups, sauces breads, cakes and desserts, are intended to reduce the work load of the industrial cook and the housewife in their respective kitchens. An "improved" process of manufacture invariably means a process which generates a larger number of products per man hour of labour. Since laboratory technicians, in common with other components of the labour force, demand higher salaries every year, the motivation in quality control research is largely to replace human effort by mechanized and automated analytical instruments of ever increasing complexity of design requiring comparatively little human effort per unit of output.

Furthermore, in the developed countries where transportation facilities, including facilities for the distribution of frozen materials, are readily available and where economies of scale in production are demonstrable, the trend is towards large centralized, highly mechanized, manufacturing units with a large output per unit of labour.

Such a philosophy is quite inconsistent with the needs of many developing countries where it is important to provide gainful employment for as many people as possible and where in general, labour is comparatively inexpensive. Consequently, many of the technologies which are prevalent in developed countries are ill-suited in scale and design to the needs of the less developed.

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Furthermore, highly mechanized systems, whether it be of production machinery or laboratory instruments, demand ready access to an efficient source of maintenance including spare parts. It would be interesting but probably distressing to produce an inventory of the number of instruments and machines which have been imported from developed into developing countries which are laying idle for want of adequate maintenance and repair facilities. Large centrallized manufacturing units are out of the question in those countries where road and rail transportation is inadequate to ensure reliable deliveries from farm to factory and from factory to the market place.

Finally, and briefly, one might refer to the philosophy which controls the manner in which bilateral and multilateral aid is offered by the developed to the less developed countries. Since much of the aid is tied to the goods and services of the donor country, there has been a strong tendency to devise aid programs, whether in the form of production facilities or research laboratories, which make maximum use of machines and instruments from the donor nation(s). In these circumstances, the program of work tends to be dictated by the machinery and equipment available rather than the equipment being chosen and designed to suit the needs of the optimum program.

2. Education and Training

Since this is a subject of special concern at this conference, it will be referred to only briefly here. Nevertheless, in spite of the many words written and spoken on the subject of training being appropriate to needs, one still encounters graduate students in the universities of North America and Europe carrying out research on thesis subjects which appear to bear little relevance to the priorities of their own national economic environment. Many of these graduate research programs are inapplicable both in scientific content and in the methodology and techniques involved. It is exceedingly wasteful of limited human scientific resources to train young

scientists and technologists from developing countries in techniques which require equipment that their countries can neither afford to purchase nor to maintain. Similarly to direct their intellectual energies to technically and economically unsuitable projects such as the production of microbial protein and fish protein concentrates rather than to simple and applicable methods of protecting, preserving and utilizing their indigenous food sources, appears to me not only mindless but rather cynical. Unfortunately, the criteria appear to be dictated by what is ingeneous and what will be acceptable to a refereed scientific journal rather than what is likely to prove practically useful when the graduate returns to his or her own country. It is gratifying to observe that some agencies now encourage graduate students to receive their theoretical training in a university in a developed country, where such training is not available in their own country, and to return to their own country to carry out their practical research on a problem which is directly relevant to their nation's need. This appears to be eminently sensible in that I believe it can be proposed that scientific principles are more readily transferable between different socio-economic systems than are technologies.

3. Research Systems

Throughout the developed countries one finds many institutes of food research which, though they vary in detail, tend to have been created from the same basic principles. These institutes, whether they are owned and operated by private industry or governments, or some mixture of the two, usually include product and process development laboratories, and pilot plants together with highly instrumentalized, analytical, physical and microbiological laboratories where standards of product identity and quality and process control are defined and tested.

For some of the reasons I have already cited, one finds a growing number of such institutes in developing countries. Many of these are the result of advice from foreign experts, provided by bilateral or multilateral aid agencies. In fact, where these

research institutes were equipped through multilateral or bilateral aid, the recipient governments of the developing countries were often pressed to accept a large inventory of scientific and pilot plant equipment often before the needs of the local industries, and therefore the most relevant program of research, had been defined. Under such circumstances, the program of research has tended to be selected and justified more by the nature of the equipment provided than by the immediate needs of the indigenous food and agricultural economies and processing industries. The creation of such highly equipped institutions inclines the native food scientists and technologists to remain inside their laboratories and pilot plants, standardizing and learning how to operate the equipment, rather than to working with and helping solve the problems of the existing food processing and distributing industries. Furthermore, after the aid funds dry up, the developing countries find themselves left with a very expensive institution which constitutes a drain on foreign exchange reserves in order to maintain and replace the instruments, devices and machinery originally installed.

It would seem more logical to assist the scientists of developing countries to spend more time working with their indigenous food industries, learning what are their problems and their opportunities for improvement before embarking upon the definition of a research program and the design and construction of an expensive research institution. It is my belief that the small indigenous industries of the developing countries would benefit far more from technical assistance and advice which would enable them to operate more efficiently the machinery and equipment they already possess than being offered new products and processes demanding of capital investment they often cannot afford. Furthermore, foreign "advisers" and "experts" might do well to spend more time listening than advising the people of the developing countries who generally are far better aware of their own problems than are those from other countries.

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Most important, we should all try to avoid the danger of carrying a solution which is looking for a problem. In the past, too little time has been devoted to thoroughly understanding the problems of food preservation and distribution in developing countries, particularly the economic, social and logistic aspects of the problem, before offering a technological remedy.

Also, too little opportunity has been afforded to the scientists and technologists of developing countries to meet together and solve their own problems. One extremely interesting development has taken place in South and Southeast Asia where the food scientists of that region have created a working group which has come together on several occasions and has defined problems of common interest to the whole region and is now developing a series of networks of projects related to the principal problems, each project being complementary to the needs of the whole region. It is suggested that much greater encouragement and support should be given to such cooperative effort in which scientists and technologists from a region meet together frequently and develop a cooperative research and development program directly relevant to the needs of all of their countries. The Southeast Asian group, in addition to its other activities have produced an interesting directory which lists and classifies all of the research in food science and technology which is in progress throughout the region. It is also establishing a technical information and technical literature service throughout the region.

4. Direct Industrial Transfers

Many developing countries have sought to import processing technologies through licencing agreements with food processing companies in developed countries. In addition to the difficulties of transplanting total technological systems or components of such systems into an unfamiliar and uncongenial environment, the direct cost of technology transfers may prove exceedingly burdensome to recipient developing countries.

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The direct costs of technology transfer include the right to use patents, licences, manufacturing and marketing know how, trademarks, advertising materials and technical support services. An UNCTAD study in 1971 estimated that for all developing countries during 1968 the direct cost of technology transfer amounted to $1.5 billion in foreign exchange and that direct transfer costs to developing countries are increasing at the rate of roughly 20% per annum. If this trend is extrapolated in constant dollars, the result will be a net foreign exchange debit to the developing countries of nearly $9 billion by 1980.

Governments of LDCs which enter into technology transfer agreements may find themselves bearing a heavy burden of indirect costs, including the deliberate over-pricing of raw materials, capital goods and equipment sold by the parent in a developed country to its subsidiaries or licencees in less developed countries. Such deliberate over-pricing is a means by which the parent company can quickly repatriate its foreign investment. For the developing country it represents an extremely heavy drain on its foreign exchange resources.

Many such licencing contracts include restrictive clauses. In a study of the five countries of the Andean Pact it was discovered that more than 70% of such licencing contracts between food and beverage companies in that region and related companies in developed countries prevented exports of the products manufactured by the Latin American licencees.

There have been many sorry instances in which developing countries have been persuaded by foreign experts to purchase and install food processing facilities quite unsuited to their needs. It is obviously necessary for the developing countries to increase their own technical expertise and resources in order

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to be able to make the best possible choices among the alternative technologies available to them and also to recognize when none of the processing systems commercially available is ideally suited to their needs. While it may be many years before every developing country can have within its own boundaries all of the expertise it needs, there is here again, I believe, an opportunity for developing nations to cooperate with one another and to establish regional research and technical advisory services so that Asians are advising Asians, Africans are advising Africans and that the developing countries of these regions are not entirely dependent upon the expatriates of the more developed nations.

In summary, I would urge that every encouragement be given to systems of research, technological development and adaptation which enable groups of developing countries to cooperate together to solve their common problems and to realize their common opportunities; that governments of developing countries seek to become less dependent upon the more developed countries both for technological transfers and advice; and that multilateral and bilateral programs of technological assistance be administered in less restrictive terms and that adequate resources and time be assigned to permit clear and comprehensive definition of technological needs before any solutions, particularly those which may involve costly technological transfers, are recommended.